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(54) **PLASMA-ARC CUTTING MACHINE AND A METHOD OF CONTROLLING THE SAME**
PLASMABOGEN-SCHNEIDEVORRICHTUNG UND DEREN REGELUNG
MACHINE DE COUPE A L'ARC DE PLASMA ET PROCEDE DE COMMANDE

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(73) Proprietor: **KABUSHIKI KAISHA KOMATSU SEISAKUSHO**
Minato-ku Tokyo 107 (JP)

(72) Inventors:
- **YAMAGUCHI, Yoshihiro**
Hiratsuka-shi Kanagawa 254 (JP)
- **KUROKAWA, Iwao**
Hiratsuka-shi Kanagawa 254 (JP)

(74) Representative: **Meissner, Peter E., Dipl.-Ing. et al**
Meissner & Meissner,
Patentanwaltsbüro,
Postfach 33 01 30
14171 Berlin (DE)

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Description

Technical Field:

The present invention relates to a plasma arc cutter for cutting workpieces with high precision and high efficiency and a method of controlling the same.

Background Art:

JP-A-51-78765 discloses a plasma arc cutter having at least an inverter circuit for converting a commercial alternating current into a predetermined high-frequency alternating current, a rectifying circuit connected to an output terminal of said inverter circuit and a smoothing reactor connected in series to said rectifying circuit. A further comarable plasma arc cutter is known from JP-A-60-6750. Last a method for pilot and main current control is known from JP-A-63-36974.

For a better understanding of the present invention a conventional plasma arc cutter having a configuration such as the one shown in Fig.1 should be explained first.

A commercial alternating current 1 is converted into a direct current by a rectifying circuit 2 composed of a diode. The DC output from this rectifying circuit 2 is converted into an alternating current having a predetermined frequency as transistors 5, 6 are alternately switched by base currents alternately output from a control circuit 8 to the bases of the transistors 5, 6 of an inverter circuit 7 composed of capacitors 3, 4 and the transistors 5, 6. Furthermore, an AC output of the inverter circuit 7 is transformed by a transformer 9 and is then converted into a DC output capable of stably maintaining an arc discharge by means of a serial circuit 12 composed of a rectifying circuit 10 and a smoothing reactor 11.

Upon starting of an arc discharge, a contact 13 is closed, and an operating gas is supplied to a gas passage 16 between an electrode 14 and a nozzle 15 of a plasma torch 18. When the operating gas flows, the inverter circuit 7 is actuated, and a voltage which sets the electrode 14 to minus and the nozzle 15 and the workpiece 17 to plus is applied to the plasma torch 18. At this stage, however, although a voltage (no-load voltage) is produced between the electrode 14 and the nozzle 15, dielectric breakdown has not occurred, neither a current flows. Then, a high-frequency generating circuit 19 is operated, and a high-frequency high voltage is generated at both ends of the secondary coil (electrode-side connection 21) of a coupling coil 20. This high-frequency high voltage is applied by a bypass capacitor 22 to between the electrode 14 and the nozzle 15 in such a manner as to be superposed on the aforementioned no-load voltage. Thus, dielectric breakdown occurs due to a high-frequency discharge, followed by the generation of a pilot arc and then an arc discharge.

At this time, the rise of a current supplied from the serial circuit 12 composed of the rectifying circuit 10 and the smoothing reactor 11 is delayed by the action of the smoothing reactor 11. Accordingly, a compensation circuit 28 composed of a capacitor 23 and a resistor 24 is provided in parallel in the serial circuit 12. The capacitor 23 is charged up to a no-load voltage produced at the opposite ends of the rectifying circuit 10 at the time when the inverter circuit 7 begins to operate. If the impedance between the electrode 14 and the nozzle 15 declines due to the dielectric breakdown caused by the high-frequency discharge, the capacitor 23 discharges via the resistor 24 and a resistor 25 so as to compensate the serial circuit 12 in whose current rise is slow, thereby allowing a pilot arc to be generated positively. In this case, the current value of the pilot arc is determined autonomously in such a manner that the voltage of the pilot arc and a voltage drop in the resistor 25 due to the current of the pilot arc are brought into equilibrium with the voltage of the serial circuit 12 thanks to the current and voltage characteristics of the serial circuit 12. A current detector 26 is adapted to detect a pilot arc current and stop the high-frequency generating circuit 19. When electrical conductance is secured between the electrode 14 and the workpiece 17 by being led by a pilot arc, the capacitor 23 discharges in a main arc circuit constituted by the electrode 14 and the workpiece 17 by means of the resistor 24, and then the current of the serial circuit 12 is supplied, thereby continuing the discharge. If the supply of the current from the serial circuit 12 is confirmed by the current detector 27, the contact 13 is opened, to stop the pilot arc, and a complete main arc discharge follows. The main arc discharge is maintained at a fixed level as a signal corresponding to that current is supplied to the control circuit 8 by the current detector 27 and the switching timing of the transistors 5, 6 is subjected to feedback control.

In addition, conventionally, one plasma torch 18 is provided by using the power source circuit such as the one described above, and, as shown in Fig. 2, such processing as boring (point A1) and cutting (line A2) is performed (piercing start method).

Furthermore, as a method of stopping the arc, following two methods are available: (1) a normal cutting completion method in which the power source is stopped while the plasma torch 18 is located above the workpiece 17 so as to extinguish the main arc, as shown in Fig. 3(b), and (2) a forced cutting completion method in which the plasma torch 18 is separated completely from the workpiece, making it impossible to maintain the main arc and thus extinguishing the arc. However, in cases where the workpiece 17 is cut off, as shown in Fig. 4(a), or the external configuration is used as a product after the inner configuration is cut off, as shown in Fig. 4(b), if the normal cutting completion method is used, there are cases where an uncut portion is left, and it is difficult to provide a timing for the movement of the plasma torch and a stop signal for the power source. Accordingly, the forced cutting completion method, in which point E after passing point B is used as a completion point, is usually employed in such cases. According to this method, as shown in Fig. 5(a), a main arc 60 is drawn in the form of a discharge of a normal configuration, and the possibility of the arc being extinguished is small. In many cases, the arc is extinguished after undergoing the state of a double arc 61 (a part or a substantial portion of the current forms a double current path via the nozzle body without passing through the orifice of the nozzle 15), as shown in Fig. 5(b).

In cutting a workpiece with high precision and high efficiency by using such a plasma arc cutter, the following points are desirable:

(1) The diameter of the orifice is made small so as to restrict the arc, thereby enhancing the current density of the arc.
(2) The amount of dross adhering to the nozzle is kept to a minimum.
(3) The occurrence of a double arc, which results in the deterioration of the nozzle and a decline in cutting quality, is prevented.

With the conventional art, however, the following problems are encountered:

(1) Following a high-frequency discharge, a pilot arc is ignited, but a nozzle-side arc arrival point is located upstream of the orifice, is blown to the downstream side by the current of the working gas, passes through the orifice and moves to the main arc. In this case, if the diameter of the orifice is small, when the pilot arc is ignited, the working gas expands suddenly by the heat caused by the arc. Hence, the flow rate of the gas at the orifice declines, and the action of the gas current moving the arc arrival point declines, thereby delaying a shift from the pilot arc to the main arc. Since the pilot arc causes an arc discharge by using the nozzle as an anode, deterioration of the nozzle is entailed. Therefore, if the shift to the arc discharge is delayed, the deterioration of the nozzle advances, resulting in a decline in the cutting performance. If the starting of such an arc is repeated, the deterioration of the nozzle advances rapidly, it is difficult to reduce the diameter of the orifice in the nozzle.
(2) In order to prevent the dross from being blown up and being attached to the nozzle, the distance (i.e., stand-off) between the workpiece and the plasma torch may be made larger than at the time of cutting in a steady state. However, if the stand-off is made large, the shift from the pilot arc to the main arc becomes difficult, so there are limitations to making the stand-off large.
(3) The invention of Japanese Patent Laid-Open No. 24864/1987 has been proposed as a method of detecting the limit of using an electrode by paying attention to voltage fluctuations entailed by the deterioration of the electrode. However, at present no appropriate means can be found for preventing in advance the occurrence of the double arc itself.

The present invention has been devised in light of the above-described problems, and an object of the present invention is to provide a plasma arc cutter which is capable of cutting workpieces with good precision and high efficiency and a method of controlling the same.

Disclosure of Invention:

Accordingly, in accordance with a plasma arc cutter and a method of controlling the same, there is provided a plasma arc cutter having an inverter circuit for converting a commercial alternating current into a predetermined high-frequency alternating current, a rectifying circuit connected to an output terminal of the inverter circuit, a smoothing reactor connected in series to the rectifying circuit, an electrode of a plasma torch connected to the cathode side of a serial circuit composed of a rectifying circuit and a smoothing reactor via a coupling coil for generation of an arc starting high-frequency voltage, a workpiece connected to the anode side of the serial circuit, and a nozzle of the plasma torch similarly connected to the anode side via a resistor and a contact, the plasma arc cutter characterised in that, with respect to the serial circuit composed of the rectifying circuit and the smoothing reactor, a rise compensating circuit and a shift compensating circuit both composed of a charging and discharging capacitor and a resistor are respectively inserted in parallel between an electrode-side connection and a nozzle-side connection and between the electrode-side connection and a workpiece-side connection, and that a diode is provided on the workpiece-side connection in such a manner as to be inserted between a connecting point of the nozzle-side connection and a connecting point of the shift compensating circuit. In addition, a detector for controlling a current is provided on the electrode-side connection at a position closer to the electrode side than a connecting point of the rise compensating circuit. Furthermore, a detector for detecting a shift is provided on the workpiece-side connection at a position closer to the workpiece side than the connecting point of the shift compensating circuit.

A pilot arc is generated on the basis of a current value set by current control, and after a shift from the pilot arc to a main arc takes place, the set current value is changed over to a current value set by the current control of the main arc.

In addition, at the time of effecting piercing for boring and cutting, at least one plasma torch for boring and at least one plasma torch for cutting are provided.

By virtue of the above-described arrangement, the current of the pilot arc is subjected to current control by the inverter circuit in the same way as the current of the main arc, with the result that the current of the pilot arc is stabilized. Accordingly, it is possible to maintain the pilot arc with a lower current. The amount of heating can consequently be reduced, and the amount of expansion is made small. The flow of the operating gas at the nozzle orifice is made smoother, and the shift from the pilot arc to the main arc is facilitated. Accordingly, the diameter of the nozzle can be reduced, and the stand-off can be increased.

In addition, the possibility of cutting being effected by using a plasma torch damaged by the blowing up at the time of boring can be reduced substantially to nil, with the result that cutting precision is increased.

Moreover, if the distance between the plasma torch and the workpiece becomes large after completion of cutting, the main arc is drawn and the voltage rises sharply. When the voltage exceeds a limit, the arc shifts to a double arc, causing the voltage to decline. When that distance becomes far larger, the voltage rises again, but it becomes impossible to maintain the discharge by even the double arc (broken line in Fig. 11(b)) and the arc is thereby extinguished. Accordingly, it is possible to prevent the occurrence of a double arc if the power source is stopped by detecting voltage PC (PC < PD) after voltage PB rises sharply upon completion of cutting and before it reaches limit PD for generation of a double arc.

Brief Description of the Drawings:

Fig. 1 is a circuit diagram of a power source for a plasma arc cutter in accordance with the conventional art;

Fig. 2 is a diagram illustrating the boring and cutting of a workpiece by means of a plasma arc;

Figs. 3(a) and 3(b) are conceptual diagrams at the time of completion of plasma arc cutting in accordance with the conventional art;

Fig. 4(a) and 4(b) are conceptual diagrams of a conventional plasma arc cutting process;

Figs. 5(a) and 5(b) are conceptual diagrams illustrating the occurrence of a double arc in accordance with the conventional plasma arc cutting process;

Fig. 6 is a circuit diagram of a power source for a plasma arc cutter in accordance with a first embodiment of the present invention;

Fig. 7 is a circuit diagram of a power source for a plasma arc cutter in accordance with a second embodiment of the present invention;

Fig. 8 is a front elevational view of the plasma arc cutter in accordance with the second embodiment of the present invention;

Fig. 9 is a cross-sectional view taken along the line IX-IX of Fig. 8;

Best Mode for Carrying Out the Invention:

Fig. 6 is a circuit diagram of a power source for a plasma arc cutter in accordance with a first embodiment of the present invention. The components that are identical with those of Fig. 1 which illustrates the conventional art are denoted by the same reference numerals, and a description thereof will be omitted.

In Fig. 6, a detector 31 for controlling a current is provided on an electrode-side connection 21 between an electrode 14 and a smoothing reactor 11, and a detector 32 for confirming a shift and a diode 33 are provided on a workpiece-side connection 34 between a workpiece 17 and a rectifying circuit 10. A nozzle-side connection 35 is connected to a nozzle 15 and a connecting point 36 provided between the rectifying circuit 10 on a workpiece-side connection 34 and the diode 33, a contact 13 and a resistor 25 being provided in series on the nozzle-side connection 35 itself. A capacitor 40 for igniting a pilot arc and a resistor 41 are provided in a rise compensating circuit 39 disposed between a connecting point 37 between the detector 31 on the electrode-side connection 21 and the smoothing reactor 11 on the one hand, and a connecting point 38 on the nozzle-side connection 35 on the other. In addition, a capacitor 45 for shifting from a pilot arc to a main arc and a resistor 46 are provided in a shift compensating circuit 44 disposed between a connecting point 42 between the detector 31 on the electrode-side connection 21 and the smoothing reactor 11 on the one hand, and a connecting point 43 between the diode 33 on the workpiece-side connection 34 and the detector 32 on the other.

The operation will be described below on the basis of the above-described arrangement. At the time of starting, a pilot arc is generated after dielectric breakdown takes place due to a high-frequency discharge. However, since the rise in a current takes place by means of the exclusively provided rise compensating circuit 39, the rise can be effected smoothly without any delay. At this juncture, a discharge current from the pilot arc igniting capacitor 40 is detected by the detector 31 and controlled by a control circuit 8 in such a manner that a control current will rise as the discharge current attenuates. Accordingly, its current value is maintained at a substantially constant value without excessively exceeding a preset value. Subsequently, during a shift from a pilot arc to a main arc, the discharge current from the shifting capacitor 45 is also detected by the detector 31 and controlled by the control circuit 8 in such a manner that a control current will rise as the discharge current attenuates. As a result, its current value is also maintained at a substantially constant value. In addition, since the two systems of the rise compensating circuit 39 and the shift compensating circuit 44 are provided separately, and the reverse-blocking diode 33 is disposed on the workpiece-side connection 34, the voltage between the electrode 14 and the the workpiece 17 does not fall below no-load voltage, thereby facilitating a shift from the pilot arc to the main arc. The shift can be effected smoothly even if the diameter of the orifice in the nozzle 15 is small and the stand-off is high. Furthermore, if the shift from the pilot arc to the main arc is confirmed by the detector 32, the control circuit 8 is changed over to a mode for controlling the current of the main arc, and the discharge current of the main arc is detected by the detector 31 and is fed back to the control circuit 8.

Figs. 7 to 9 are a circuit diagram of a power source for a plasma arc cutter in accordance with a second embodiment of the present invention, a front elevational view of the cutter, and a cross-sectional view thereof, respectively. In Fig. 7, a plasma torch 18a used exclusively for boring and a plasma torch 18b used exclusively for cutting are provided, electrodes 14a, 14b of the plasma torches 18a, 18b being connected to the electrode-side connection 21. Nozzles 15a, 15b are connected to the nozzle-side connection 35 via contacts 13a, 13b, respectively. The contacts 13a, 13b are opened and closed in response to signals from the control circuit 8.

In Figs. 8 and 9, the plasma torches 18a, 18b are juxtaposed on a torch mounting shaft 51 and are adapted to slide in the X-direction along rails 53 by means of a ball screw for torches. The rails 53 are secured to a moving frame 54 which is adapted to slide in the Y-direction by means of a moving ball screw 57 along a guide 56 fixed on a table 55.

The operation will be described hereafter on the basis of the above-described arrangement. At the time of processing the workpiece 17, the control circuit 8 first supplies a signal to the contact 13a for the plasma torch 18a used exclusively for boring so as to close the same. Then, in the same way as the first embodiment, a shift takes place from the pilot arc to the main arc, and boring is performed. At the time of completion of boring, a change in the discharge current is detected by the detector 31, and the control circuit 8 supplies a signal to the contact 13a to open the same, thereby stopping energization of the plasma torch 18a used exclusively for boring. The torch mounting shaft 51 and the moving frame 54 are moved by predetermined amounts, and the plasma torch 18b used exclusively for cutting is moved to the boring completed position. After a predetermined period of movement has elapsed, the control circuit 8 supplies a signal to the contact 13b for the plasma torch 18b used exclusively for cutting so as to close the same. Then, in the same way as the first embodiment, a shift takes place from the pilot arc to the main arc, and cutting is performed. By virtue of movement in the X- and Y-directions, the workpiece 17 placed on the table 55 and connected to the workpiece-side connection 34 can be processed with good precision and high efficiency in an integrated process covering boring and cutting.

It should be noted that although the plasma torch is moved in the X- and Y-directions by means of the ball screws, a motor and an encoder may be used alternatively. Although boring is detected by the current detector, it may be detected by placing an optical sensor, a temperature sensor, etc., below the workpiece. In addition, although the contact is provided on only the nozzle-side connection, it goes without saying that the contact may also be provided on the electrode-side connection. Furthermore, although the circuit of the first embodiment of the present invention is used as a power source circuit, a conventional power source circuit may be used.

Industrial Applicability:

As described above, in the plasma arc cutter and the method of controlling the same in accordance with the present invention, a shift from the pilot arc to the main arc is facilitated, and the diameter of the nozzle orifice can be made small. Accordingly, the current density can be enhanced, and the stand-off can be set to a high level. In addition, the possibility of cutting being effected by using a plasma torch damaged during boring is reduced substantially to nil, and the occurrence of a double arc during cutting is prevented, the plasma arc cutter and the method of controlling the same in accordance with the present invention are suitable to cutting a workpiece with high precision and high efficiency.

Claims

1. A plasma arc cutter having an inverter circuit for converting a commercial alternating current into a predetermined high-frequency alternating current, a rectifying circuit connected to an output terminal of said inverter circuit, a smoothing reactor connected in series to said rectifying circuit, an electrode of a plasma torch connected to the cathode side of a serial circuit composed of a rectifying circuit and a smoothing reactor via a coupling coil for generation of an arc starting high-frequency voltage, a workpiece connected to the anode side of said aerial circuit, and a nozzle of said plasma torch similarly connected to said anode side via a resistor and a contact, said plasma arc cutter characterised in that, with respect to said serial circuit composed of said rectifying circuit and said smoothing reactor, a rise compensating circuit and a shift compensating circuit both composed of a charging and discharging capacitor and a resistor are respectively inserted in parallel between an electrode-side connection and a nozzle-side connection and between said electrode-side connection and a workpiece-side connection, that a diode is provided on said workpiece-side connection in such a manner as to be inserted between a connecting point of said nozzle-side connection and a connecting point of said shift compensating circuit, that a detector for controlling a current is provided on said electrode side connection at a position closer to the electrode side than a connecting point of said rise compensating circuit, and that a detector for detecting a shift is provided on said workpiece-side connection at a position closer to the workpiece side than said connecting point of said shift compensating circuit.

2. A plasma arc cutter according to claim 1, characterized in that at least one plasma torch for boring and at least one plasma torch for cutting are provided to the effect boring and cutting.

3. A method of controlling a plasma arc cutter having an inverter circuit for converting a commercial alternating current into a predetermined high-frequency alternating current, a rectifying circuit connected to an output terminal of said inverter circuit, a smoothing reactor connected in series to said rectifying circuit, an electrode of a plasma torch connected to the cathode side of a serial circuit composed of a rectifying circuit and a smoothing reactor via a coupling coil for generation of an arc starting high-frequency voltage, a workpiece connected to the anode side of said serial circuit, and a nozzle of said plasma torch similarly connected to said anode side via a resistor and a contact, said method of controlling a plasma arc cutter characterized in that a pilot arc is generated on the basis of a current value set by a current control corresponding to each action of a rise compensating circuit and a detector for controlling a current, that a shift from said pilot arc to a main arc is taken on the basis of a current value set by the current control corresponding each action of a shift compensating circuit and a detector for detecting a shift and that said main arc is controlled on the basis of a current value set by the current control of said main arc corresponding to an action of the detector for controlling a current.

Patentansprüche

1. Plasmastrahlschneidbrenner, zu dem eine Umrichterschaltung zum Umformen eines Industrie-Wechselstroms in einen definierten Hochfrequenz-Wechselstrom, eine Gleichrichterschaltung, die an einen Anschluß der Umrichterschaltung angeschlossen ist, eine Glättungsdrossel, die mit der Gleichrichterschaltung in Reihe geschaltet ist, eine Elektrode eines Plasmabrenners, die mit der Katodenseite einer Reihenschaltung, bestehend aus einer Gleichtrichterschaltung und einer Glättungsdrossel, über eine Kopplungsspule zur Erzeugung einer Hochfrequenzzündspannung verbunden ist, ein Werkstück, das an die Anodenseite der Reihenschaltung angeschlossen ist, und eine Düse des Plasmabrenners, die ebenfalls über einen Widerstand und einen Kontakt an die Anodenseite angeschlossen ist, gehören, dadurch gekennzeichnet, daß der Reihenschaltung, bestehend aus der Gleichrichterschaltung und der Glättungsdrossel, eine Anstiegskompensationsschaltung und eine Übergangskompensationsschaltung, die beide aus einem Lade-, einem Entladekondensator und einem Widerstand bestehen, zwischen einer elektrodenseitigen und einer düsenseitigen Verbindungsleitung bzw. zwischen einer elektrodenseitigen und einer werkstückseitigen Verbindungsleitung parallelgeschaltet sind, daß eine Diode an der werkstückseitigen Verbindungsleitung so angeschlossen ist, daß sie zwischen einen Anschlußpunkt des düsenseitigen Anschlusses und einen Anschlußpunkt der Übergangskompensationsschaltung geschaltet ist, daß ein Geber für die Steuerung eines Stroms an der elektrodenseitigen Verbindungsleitung an einer Stelle näher an der Elektrodenseite als an einem Anschlußpunkt der Anstiegskompensationsschaltung vorgesehen ist, und daß ein Geber zur Registrierung eines Übergangs an der werkstückseitigen Verbindungsleitung näher an der Werkstückseite als der Anschlußpunkt der Übergangsschaltung vorgesehen ist.

2. Plasmastrahlschneidbrenner nach Anspruch 1, dadurch gekennzeichnet, daß mindestens ein Plasmabrenner zum Bohren und mindestens ein Plasmabrenner zum Schneiden zur Ausführung der Arbeitsgänge Bohren und Schneiden vorgesehen sind.

3. Verfahren zum Steuern eines Plasmastrahlschneidbrenners, zu dem eine Umrichterschaltung zum Umformen eines Industrie-Wechselstroms in einen definierten Hochfrequenz-Wechselstrom, eine Gleichrichterschaltung, die an einen Anschluß der Umrichterschaltung angeschlossen ist, eine Glättungsdrossel, die mit der Gleichrichterschaltung in Reihe geschaltet ist, eine Elektrode eines Plasmabrenners, die mit der Katodenseite einer Reihenschaltung, bestehend aus einer Gleichtrichterschaltung und einer Glättungsdrossel, über eine Kopplungsspule zur Erzeugung einer Hochfrequenzzündspannung verbunden ist, ein Werkstück, das an die Anodenseite der Reihenschaltung angeschlossen ist, und eine Düse des Plasmabrenners, die ebenfalls über einen Widerstand und einen Kontakt an die Anodenseite angeschlossen ist, gehören, dadurch gekennzeichnet, daß unter Zugrundelegung eines Stromwertes, der mit Hilfe einer Stromsteuerung vorgegeben wird, die auf jede Veränderung einer Anstiegskompensationsschaltung und eines Gebers für die Steuerung eines Stroms reagiert, ein Zündlichtbogen erzeugt wird, daß ein Übergang vom Zündlichtbogen zum Hauptlichtbogen unter Zugrundelegung eines Stromwertes erfolgt, der mit Hilfe einer Stromsteuerung vorgegeben wird, die auf jede Veränderung einer Anstiegskompensationsschaltung und eines Gebers für die Registrierung eines Übergangs reagiert, und daß der Hauptlichtbogen unter Zugrundelegung eines Stromwertes gesteuert wird, der mit Hilfe der Stromsteuerung des Hauptlichtbogens vorgegeben wird, die auf eine Veränderung des Gebers für die Stromsteuerung reagiert.

Revendications

1. Machine de coupe par arc à plasma ayant un circuit inverseur pour convertir un courant alternatif commercial en un courant alternatif à haute fréquence prédéterminée, un circuit redresseur relié à une borne de sortie dudit circuit inverseur, une bobine de filtrage reliée en série audit circuit redresseur, une électrode d'une torche à plasma reliée au côté cathode d'un circuit en série composé d'un circuit redresseur et d'une bobine de filtrage via une bobine de couplage pour engendrer une tension à haute fréquence amorçant un arc, une pièce à usiner reliée au côté anode dudit circuit en série, et une buse de ladite torche à plasma reliée, de façon similaire, audit côté anode via une résistance et un contact, ladite machine de coupe par arc à plasma étant caractérisée en ce que, par rapport audit circuit en série composé dudit circuit redresseur et de ladite bobine de filtrage, un circuit correcteur d'augmentation et un circuit correcteur de déphasage composés, les deux, d'une capacité à charge et à décharge et d'une résistance sont respectivement insérés en parallèle entre une liaison du côté électrode et une liaison du côté buse et entre ladite liaison du côté électrode et une liaison du côté pièce à usiner, en ce qu'une diode est prévue sur ladite liaison du côté pièce à usiner de telle manière à être insérée entre un point de liaison de ladite liaison du côté buse et un point de liaison dudit circuit correcteur de déphasage, en ce qu'un détecteur pour commander un courant est prévu sur ladite liaison du côté électrode à une position plus proche du côté électrode qu'un point de liaison dudit circuit correcteur d'augmentation, et en ce qu'un détecteur pour détecter un déphasage est prévu sur ladite liaison du côté pièce à usiner à une position plus proche du côté pièce à usiner que ledit point de liaison dudit circuit de correction de déphasage.

2. Machine de coupe par arc à plasma selon la revendication 1,
caractérisée en ce qu'au moins une torche à plasma pour percer et au moins une torche à plasma pour couper sont prévues pour l'effet de perçage et de coupe.

3. Procédé pour commander une machine de coupe par arc à plasma ayant un circuit inverseur pour convertir un courant alternatif commercial en un courant alternatif à haute fréquence prédéterminée, un circuit redresseur relié à une borne de sortie dudit circuit inverseur, une bobine de filtrage reliée en série audit circuit redresseur, une électrode d'une torche à plasma reliée au côté cathode d'un circuit en série composé d'un circuit redresseur et d'une bobine de filtrage via une bobine de couplage pour engendrer une tension à haute fréquence amorçant un arc, une pièce à usiner reliée au côté anode dudit circuit en série, et une buse de ladite torche à plasma reliée, de façon similaire, audit côté anode via une résistance et un contact, ledit procédé pour commander une machine de coupe par arc à plasma étant caractérisé en ce qu'un arc pilote est engendré sur la base d'un ensemble de valeurs de courant par une commande de courant correspondant à chaque action d'un circuit correcteur d'augmentation et d'un détecteur pour commander un courant, en ce qu'un déphasage dudit arc pilote vers un arc principal est pris sur la base d'un ensemble de valeurs de courant par la commande de courant correspondant à chaque action d'un circuit correcteur de déphasage et d'un détecteur pour détecter un déphasage, et en ce que ledit arc principal est commandé sur la base d'un ensemble de valeurs de courant par la commande de courant dudit arc principal correspondant à une action du détecteur pour commander un courant.

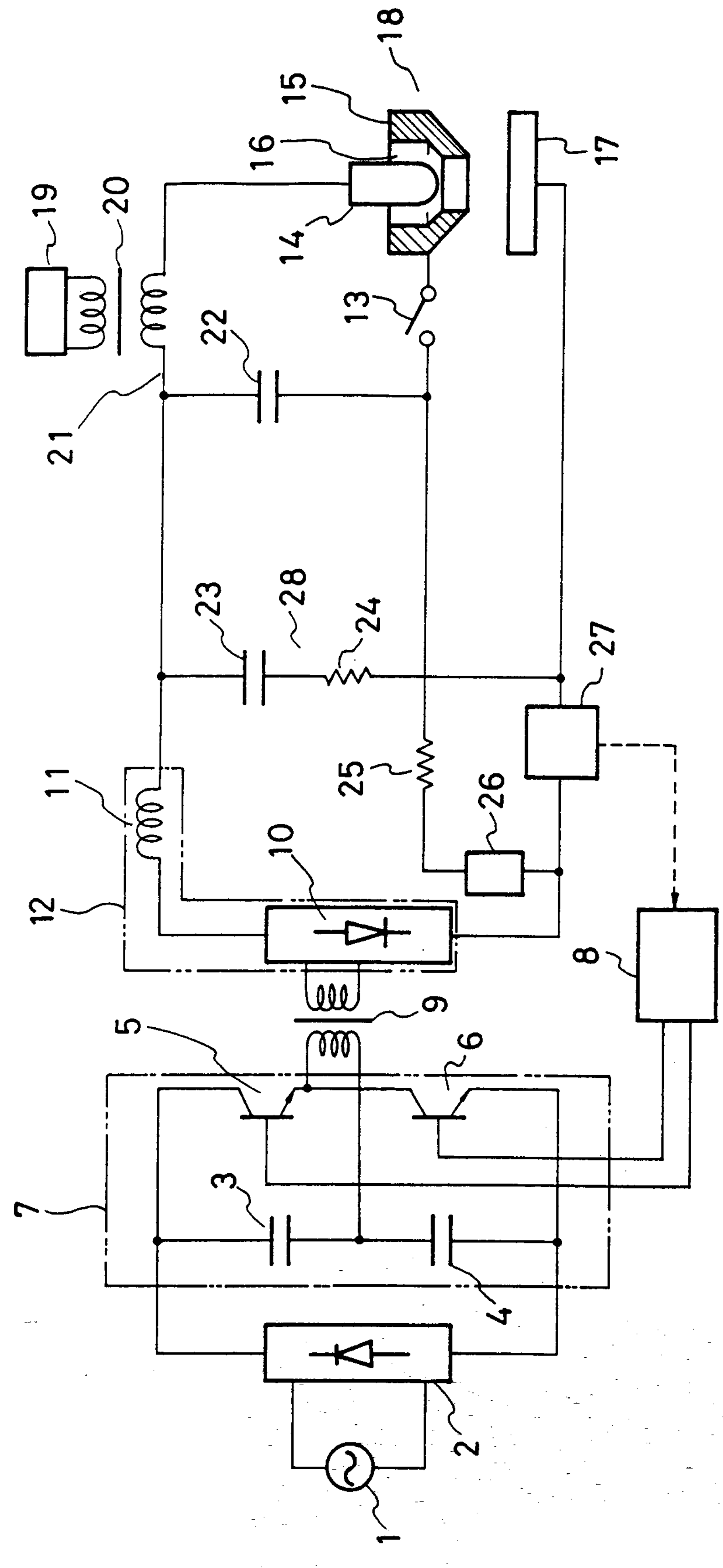

FIG.1

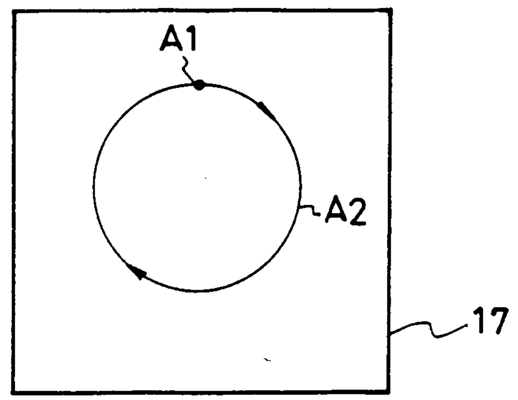

FIG.2

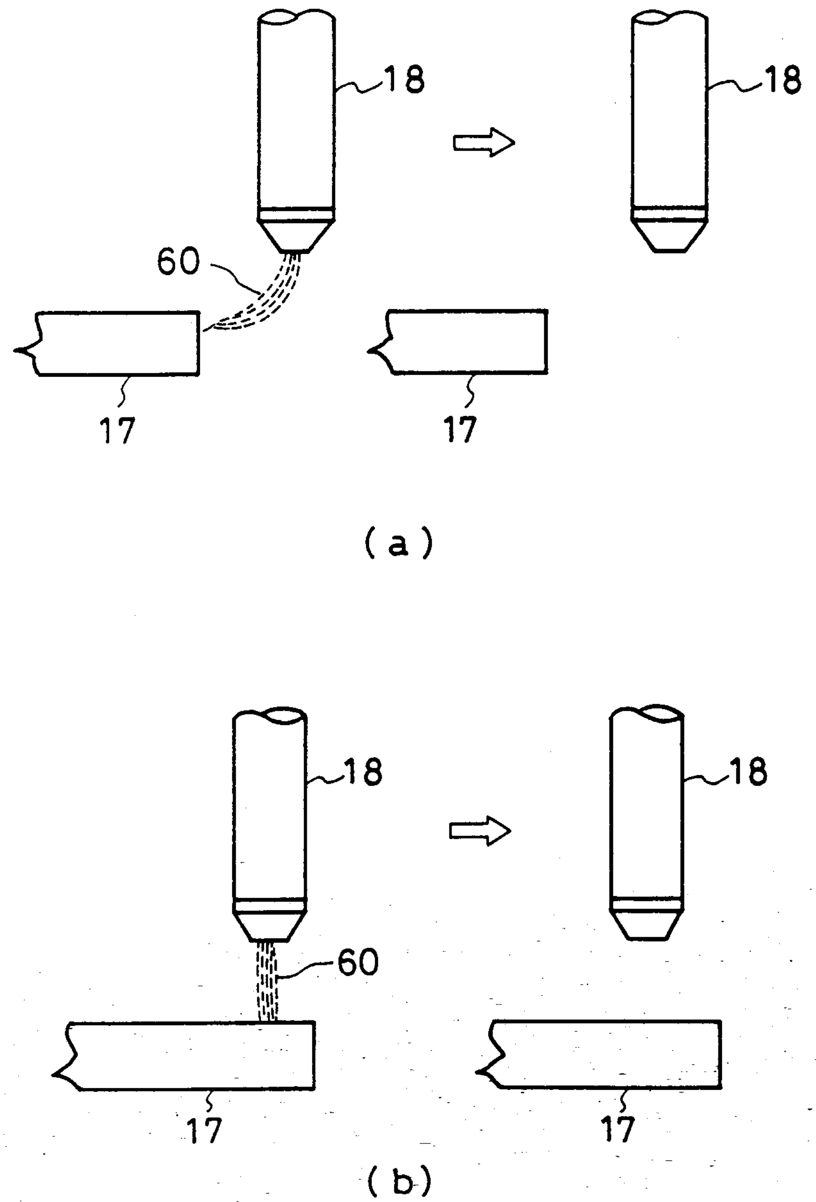

FIG.3

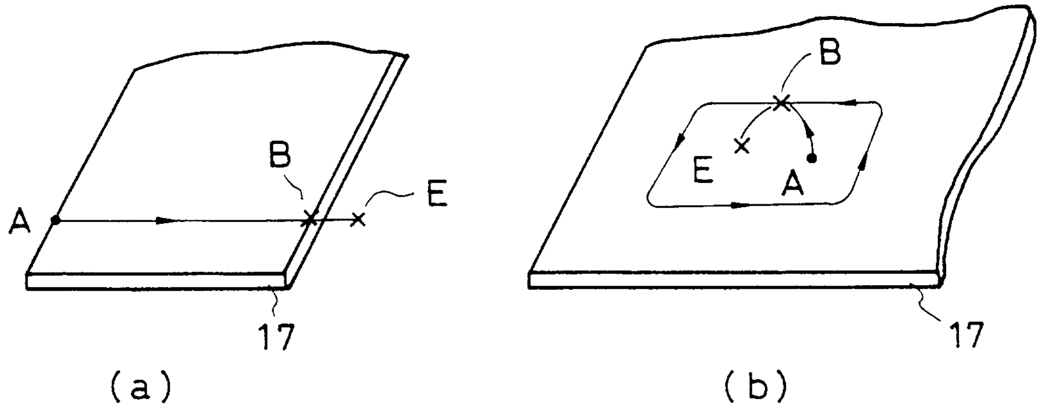

FIG.4

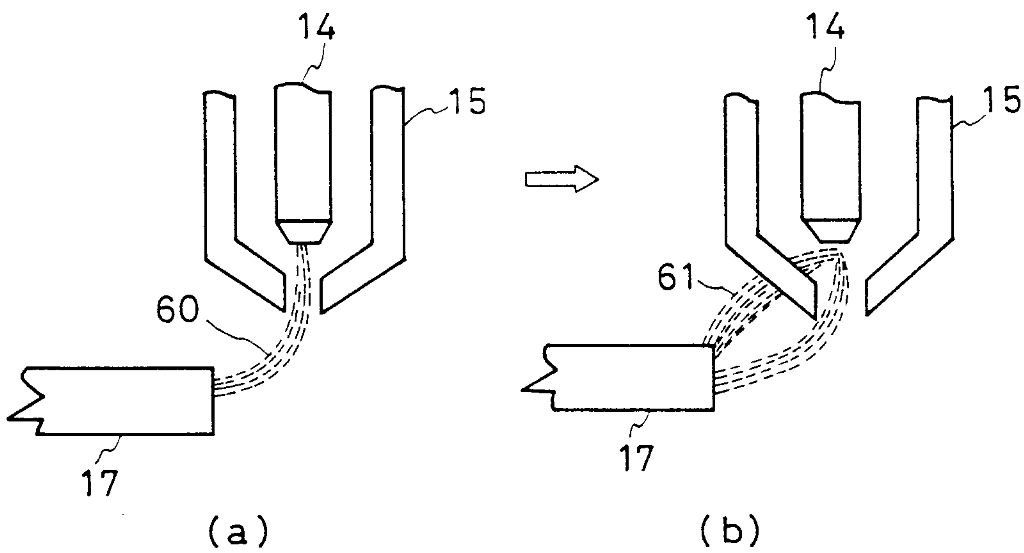

FIG.5

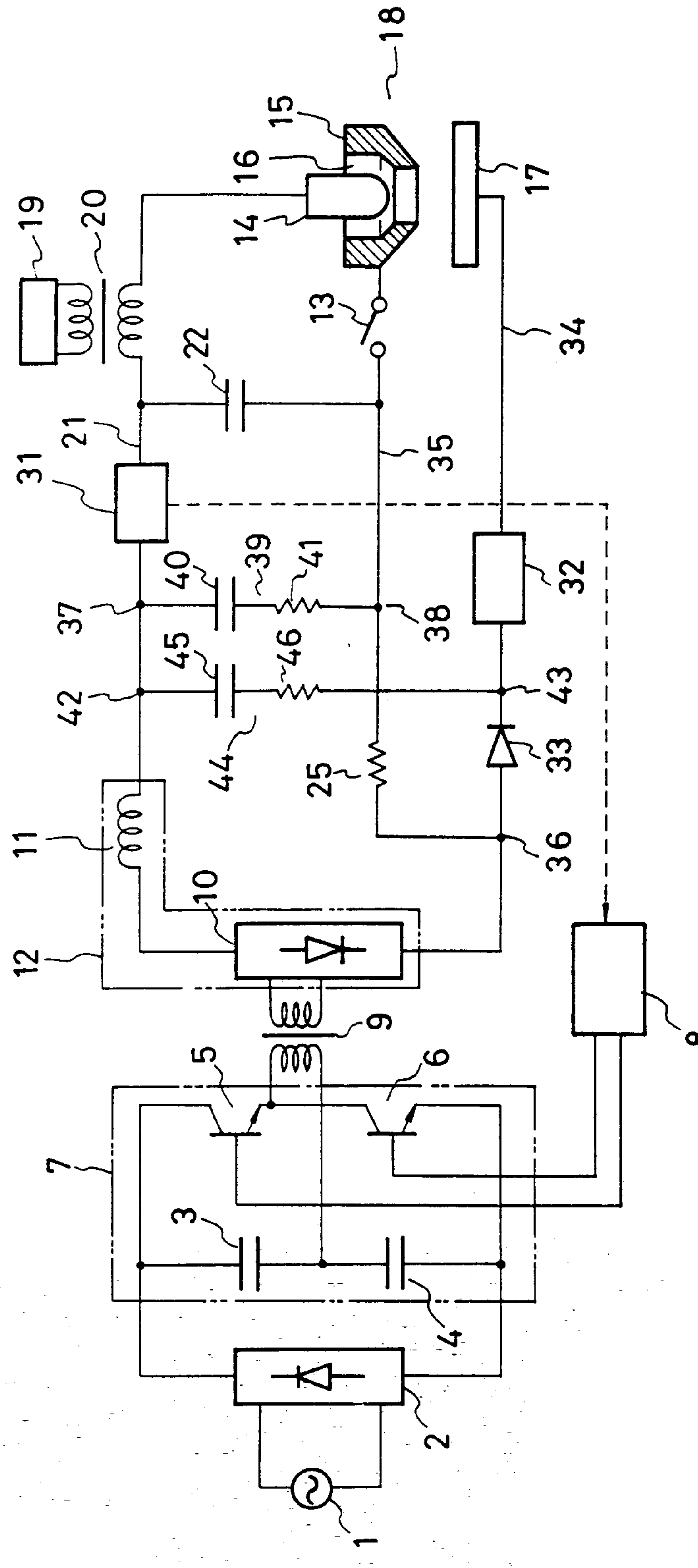

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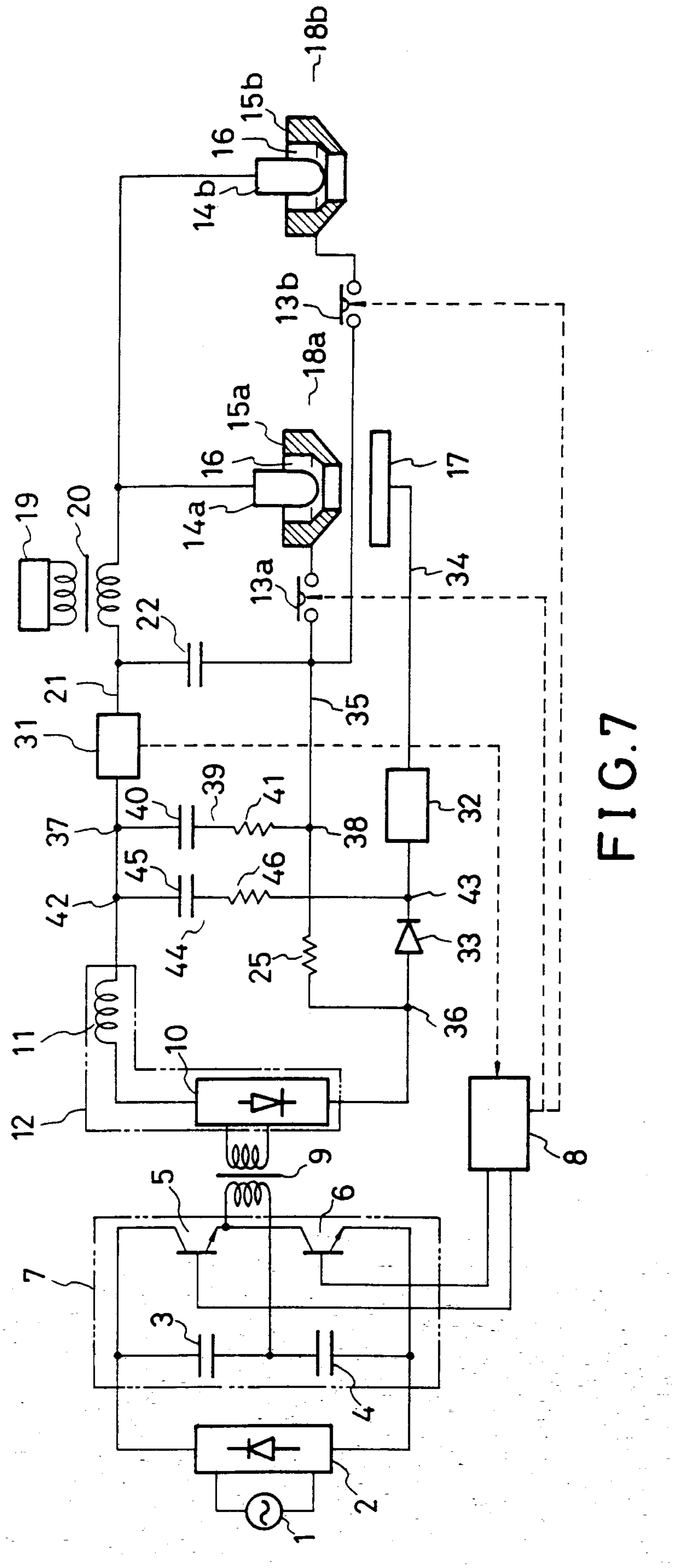
FIG.6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13b
14a
14b
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17
18a
18b
19
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FIG.7

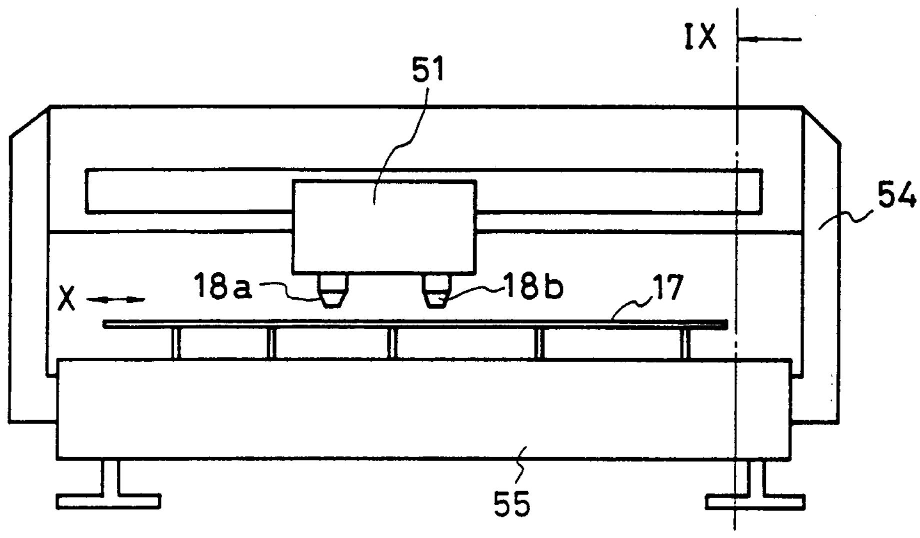


FIG.8

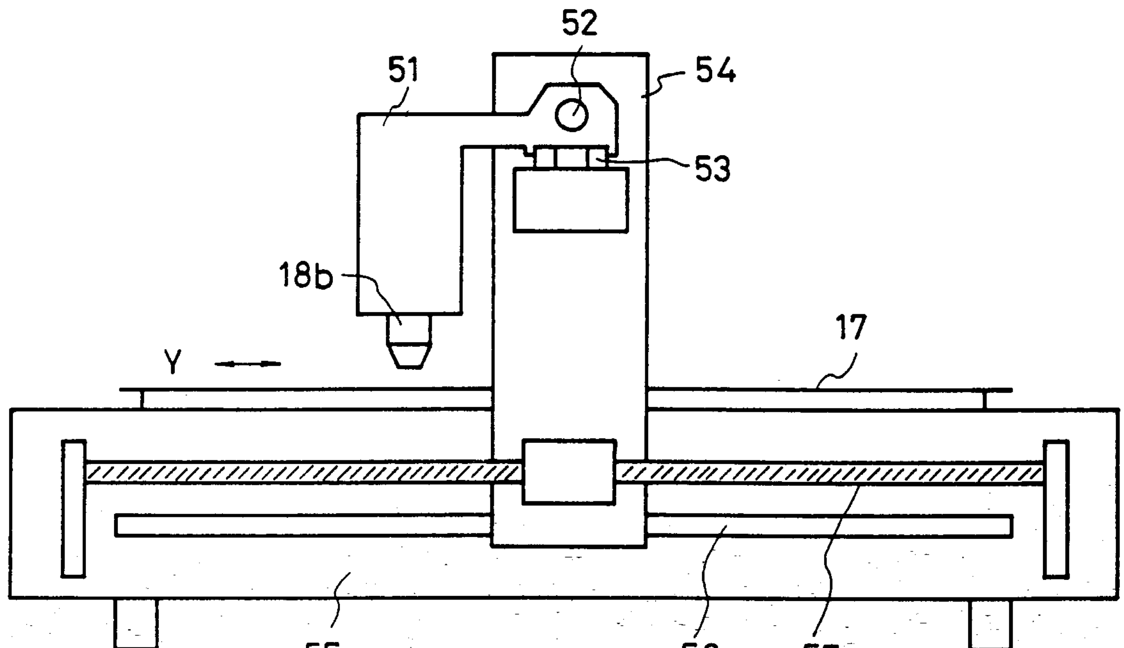


FIG.9

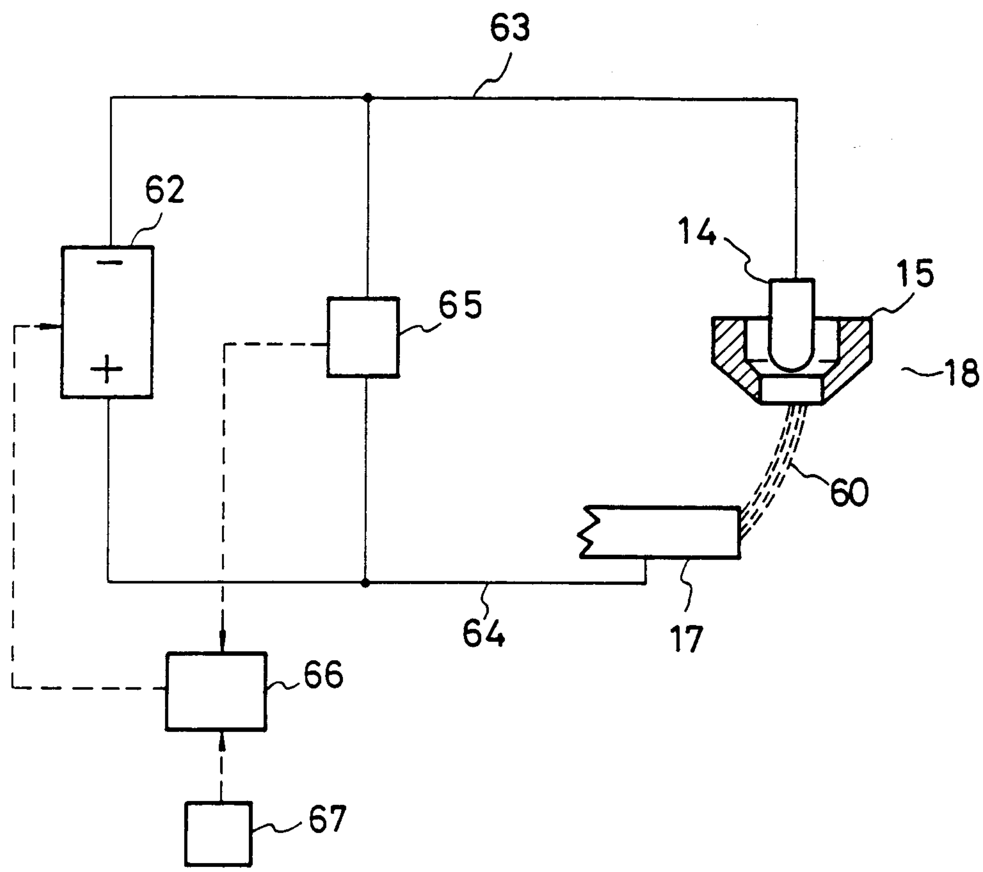
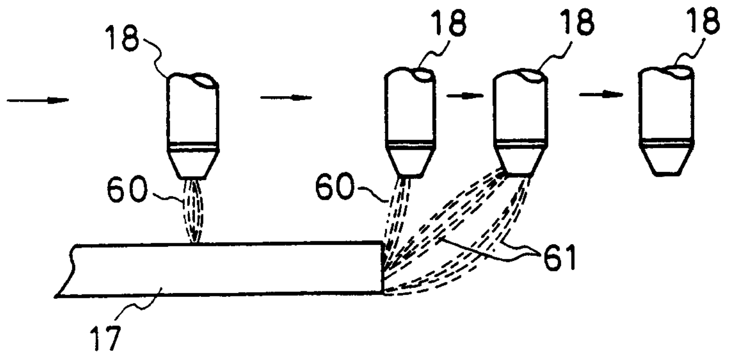


FIG.10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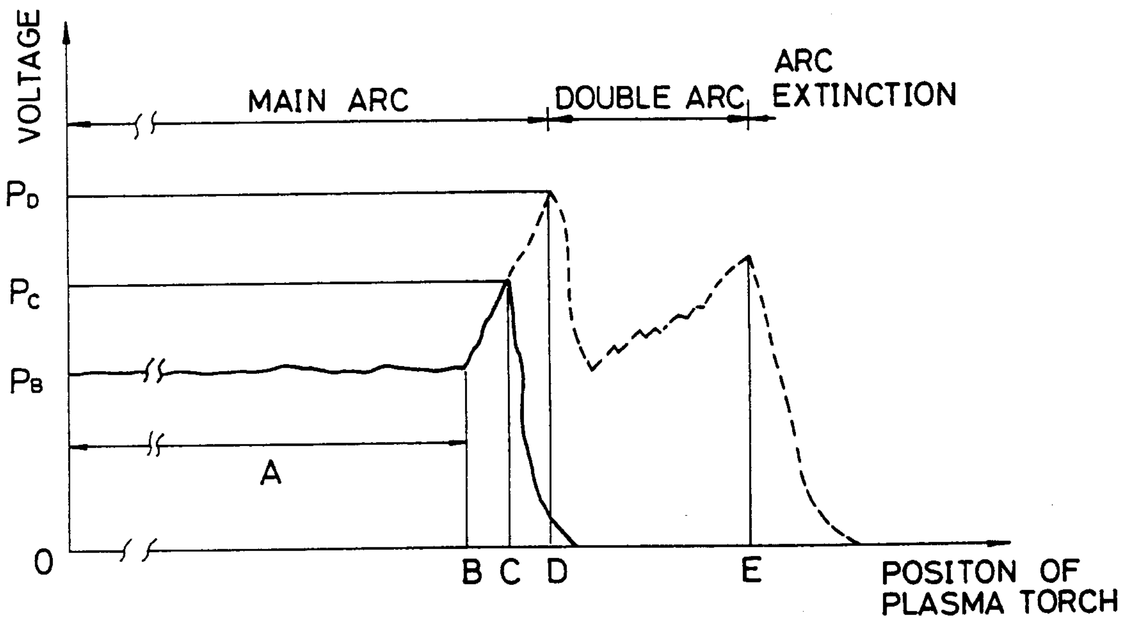
(a)


VOLTAGE
MAIN ARC
DOUBLE ARC
ARC EXTINCTION
P_D
P_C
P_B
A
0
B C D
E
POSITON OF PLASMA TORCH

(b)

FIG.11